Portfolio

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Selected Works 2022-2023

Columbia GSAPP
Master of Science. Advanced Architectural Design ’23
Trans-Scalar Intervention

01 Resourceful Network
02 Ice Research Preservation
03 Converting Hazard to Recreation

Construction Methodology

04 Tensile/Compression Surfaces
05 Rethinking BIM
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Measurement

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**Trans-scalar Intervention**

01  **Resourceful Network**  
Waste Management Infrastructure | AAD Studio Summer

02  **Ice Research Preservation**  
Ice Core Research Center | AAD Studio Fall

03  **Converting Hazard to Recreation**  
Water Filtration Facility | AAD Studio Spring
NYC produces approximately 14 million tons of waste annually, spreading to landfills in other states. We seek to change the perception of waste, looking into the concept not as a noun but as a verb, the action when a resource is being squandered, as a way of proposing strategies to see this element not as a problem but as an asset. The project looks into each category of waste to design a system of in-situ local infrastructures that can turn its current spreading cycle into a full circle.

Waste Journey by Categories

Approximately 1/4 of New York City’s household waste goes to Waste-to-Energy Center, COVANTA, and most of the rest goes to landfills located in different states or countries, causing legal, ethical, and economic problems.
There are two ways of waste collection system: Collected by Department of Sanitation or by commercial. Two systems are run by trucks requiring many street areas because the waste has to wait for each collection schedule. It affects the sanitary street environment significantly and is increasing currently due to covid-19.

Currently, 23% of the sidewalks in most of the streets in New York City are occupied by trash bags. This is equivalent of 4 pounds of waste produced by every person every day in the city, and according to the collection schedule from the Department of Sanitation, which collects waste every two days.

### Train Transfer Station, Mott Haven

There are three different kinds of transfer stations in NYC: Marine, Train, and Truck. This project starts with the train transfer station in South Bronx as a prototype of new type of waste management center. After visiting site as urban immersion, compared to other stations, this station in Mott Haven has the weakest interaction with public system and requires architectural propose to improve the city environment and human interaction.

### Trash Bags Occupying Street Area

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4 pounds per person

12 Trash Bags
occupy 10 square feet

Trash bags occupy 23% of the public space
To build a resourceful network, the current collection system has to be changed more efficiently. This project suggests a pneumatic system to directly collect and transfer the waste from households to particular collection areas, but separately by type of waste: green, blue, and black bins. The rooftop area becomes a new collection area and also can become an organic community garden. Pipes from the pneumatic system not only become a part of the city landscape and make joyful human interaction but also make the process visible so that people can be aware of the waste management system. The waste collection system primarily works as a network run by ferries to decrease the ineffectiveness of collecting by trucks, using waterways to carry waste as a material for upcycling. The waste collection system primarily works as a network run by ferries to decrease the ineffectiveness of collecting by trucks, using waterways to carry waste as a material for upcycling.
Making the Waste as an asset for the City

The liminal spaces become a working space for creators in the Bronx, using waste as material for their artwork and upcycling system. Each type of waste is reproduced; plastic to clothes, paper to books, metal to furniture, glass to glass artworks. Currently, creators and artists in the Bronx are leaving due to the dirtiness and risk of the borough. This new infrastructure can become an incubator for them, utilizing waste as an asset. Eventually, this process gives them monetary authority by selling their innovative products, such as clothes, books, furniture, and glass artworks, so that the waste produced in New York City can stay in the city and not spread anymore.

Recycling and Upcycling Process

Capacities and Quantities Projection for a Yearly Management

Sorting Process: 240,080 tons

Waste to Energy: 130,080 tons

Metal to Furniture: 8,547 tons

Plastic to Polyester: 10,000 tons

Paper to Books: 5,475 tons

Glass to Art: 6,570 tons

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Evolution System: Membrane Structure with Liminal Spaces

The inner space is defined by membrane structure made by ETFE film and machines by each process: plastic, paper, metal, and glass, and the number of machines are calibrated depending on the amount of waste produced. This project is optimizing that people will produce their waste less in the future due to the improvement of the waste collection system and designing the evolution system according to the end. Machines are displayed by process and make liminal spaces between them, which work as a public area, developing in particular phases. Membrane structures and columns are flexible to embody this system; the outer membrane defines the whole waste management infrastructure, and the inner membrane defines liminal spaces inside for people. The liminal spaces become a working space for creators in the Bronx, using waste as material for their artwork and upcycling system, eventually giving them monetary authority by selling their innovative products such as clothes, books, furniture, and glass artworks.

Evolution Scenario - The Process of Plastic

Starting Phase: Full Amount of Machines

Ending Phase: 1/3 of Machines Remaining

Phase 1: Educational Area

Phase 2: Workspace for Creators

Phase 3: Event Venue

Piston Column Detail
Ice Research Preservation

Year: 2022  
Location: Greenland  
Type: Ice Core Research Center  
Instructor: Leslie Gill, Khoi Nguyen  
Role: Individual Work
Ice Preservation

Since Arctic ice is melting, preserving ice has become more crucial than before. The maps about Active Layer Thickness and Sea Ice Thickness show how fast ice in the Arctic melts, so they visualize the importance of preserving ice for future climate research. Scientists are using ice cores for research because of their rich information. Ice cores are drilled from ice sheets, Greenland and Antarctica. Greenland has the most stable ice sheet in the Arctic, which has the lowest difference between Active Layer thickness, which means it is the perfect location to drill ice cores to study the history of climate change. Numerous ice cores have been drilled in Greenland for several decades in different locations, mainly in high-altitude areas.

Shadow Box Light Study

The Arctic has a unique light condition; it is bright all day during summer and dark during winter. Hence, it is crucial to absorb daylight from outside during summer and emit artificial light from inside to outside during winter to prevent accidents for people and flying objects such as helicopters. This study aims to study how the building absorbs and emits artificial light in the shadow box under strict-controlled conditions. The project’s initial idea was to create light refraction under the ice and water since ice core drilling is working under the ice. Moreover, this study shows how light is refracted and emitted with ice and water. Light is refracted in diverse directions; even artificial light comes from one side and sometimes creates a rainbow like a prism.

Previous Ice Core Drilling Projects in Greenland

NEEM Camp (2009-2010)
Camp Century (1961-1963)
NGRIP (1961-1963)
North Site (1972)
North Central (1972)
Summit Camp (1989-1993)
Eismitte (1930-1931)
Crete (72-74, 84-85)
Camp III (1977-1978)
ETH/CU Camp (1990-)
Camp VI (1950-1951)
DYE-1 (1955-1988)
DYE-2 (1955-1990)
GRIP2 (1989-1993)
DYE-3 (1960-1990)
DYE-4
Ice core research has been conducted primarily on Greenland, moving seasonally in summer. It uses base camps to shift their locations to set the perfect place for scientific data with about ten people. The research method divides into two purposes: deep and shallow cores. Deep core drilling needs camps because researchers must drill a snow pit and ice cores repeatedly until it hits the bedrock, a maximum of two miles. These cores are used sectionally, including the ancient atmosphere and volcanic information. Otherwise, shallow ice cores are used for horizontal data. Shallow ice core drilling works with the grid system, about 160 ft. Researchers move their campsites by a grid to gather information about ice flow and chemical elements by a grid to understand glaciology.

### Shallow Ice Core Drilling Method
- Drilling Camp
- Drilling Site
- Drilling Site with Data
- Ice Flow
- Annual Ice Layer
- Ice Core
- Snowpit
- Borehole

### Deep Ice Core Drilling Method
- Drilling Camp
- Drilling Site
- Drilling Site with Data
- Ice Flow
- Annual Ice Layer
- Ice Core
- Snowpit
- Borehole

### Ice Core Drilling Projects in Greenland
This project aims for semi-permanent research centers rather than temporal research centers before. The research center is located near the ice core drilling sites for similar climate conditions, and it moves through a particular path that follows the highest altitude of the Greenland ice sheet. Since scientists have to move around to collect different data from ice cores, the center works with five years of durability. Deep ice core drilling takes about four years, but shallow ice core drilling takes only one year. Hence, it requires four research fields to match durability with deep core drilling. After five years, parts of the building will be deconstructed except for the minimum structure, and it will turn into the visiting center and ice core museum.

Research centers for ice core drilling have to locate, under specific conditions, ice velocity. Since ice accumulates through decades, the area with the lowest ice velocity contains the richest data. This building is shaped to react to the particular path of ice velocity and tilted through the angle, reacting with different climate conditions such as wind. The research center works for five years, deconstructed partly, and rebuilt in other sites for collecting further data.
5 years Durable Cycle

This project is for designing a prototype for research centers with a five years durable cycle. This project is for designing a prototype for research centers with a five years durable cycle. This project is for designing a prototype for research centers with a five years durable cycle. This project is for designing a prototype for research centers with a five years durable cycle. This project is for designing a prototype for research centers with a five years durable cycle. This project is for designing a prototype for research centers with a five years durable cycle. This project is for designing a prototype for research centers with a five years durable cycle.

Expansion Joint

- Gym
- Core Processing
- Ice Core Storage
- Storage
- Residence
- Research Room
- Bathroom
- Kitchen
- Machine Room
Ice Core Drilling Machine Archiving

Ice Core Preservation

Ice Layer Museum
Converting Hazard to Recreation

: NYC 2100 Water Plan
New York City’s shoreline areas are currently exposed to coastal flooding by warm-season tropical storms such as Hurricane Sandy. The map shows future flood plain and high tide levels in 2100, indicating that NYC’s shoreline is highly risky for residents to keep living in the future. Hence, this project aims to convert 300 ft from the shoreline to a public area to protect civilians and provide a new lifestyle around the region.

Rain runoff water causes safety and environmental problems after a storm or flood. NYC’s annual precipitation is about 974,824 gallons, but all the runoff water goes directly to the river, sweeping the whole city and causing river water contamination. Filtering this runoff water and turning it into recreational water can be helpful to solve the environmental problem and improve people’s life quality after storms.

The project site, Anable Basin, is located in Long Island City. Since the site has a CSO (Combined Sewer Overflow) location, water drains through the contour level towards the CSO location. This project installs a water filtration facility near the location to convert CSO to recreational water.
To make public water recreational area, water retention is necessary to retain water on the landscape. Hence, new topography has to be constructed on the site to make water direction and keep the water. This model is designed with terraced topography to capture runoff water, filling water in the pouch-like area on the ground, rather than flowing away. Moreover, it creates different levels to control water direction and provide people a playground.

Models are developed sequentially, following Sol Lewitt’s instructions.

**Cut and Fill : Creating New Landscape**

The topography is made by ‘cut and fill method’ since some of the existing part from the site has to be taken to build a new shoreline edge. In order to cover massive landfills for new landscapes, existing materials are converted to new landscape. A part of the original land is taken and grinded to build a landscape with concrete debris, and bricks from the original building in Anable Basin is going to be used for constructing mosaic flat surface and creating a soft edge.

**Soft Edge for Water Retention**

12" x 12" Form Study Models
Combining Water Filtration Facility and CSO

CSO location is changed by extending pipes to combine with runoff water. All combined water moves to the water filtration facility along the elevation created by new landscapes. After the water influx, it will be processed by the filtration facility, which can handle Long Island City's annual precipitation on average. Filtered water will be clean enough for people to dive in and eventually converted into recreational water when all process is finished.

Public Water Recreational Area

Not only the swimming pool but also new landscapes will be water recreational areas. People can access the building through various ramps, stairs and a ferry dock watching water moving and draining. The whole site will be either active or passive water recreational areas and people can see and learn the system. The building is for supporting programs such as cafeteria and shower rooms for the swimming pool.
Providing Recreational Water to Public

If the water fills to a certain level, it will flow naturally due to the pool’s elevation difference and drain to the east river after usage. The edge is 11 ft high from the existing site to prevent flood hazards. Moreover, the swimming pool faces Manhattan’s skyline, providing a beautiful view while playing with the water. People can play around the pool on the landscape with a soft edge attached to the pool. The pool is transformed into an ice rink for winter to enable annual use.

Didactic Experience Sequence

People who are using the facility can see the whole process. The system is exposed so that they can learn how the water is filtered and eventually transformed into the swim water. This didactic experience helps people to understand and notice environmental changes such as sea level rises or flood hazard.
Construction Methodology

04  Tensile/Compression Surfaces
    Building Science & Technology | AAD Fall

05  Rethinking BIM
    Building Science & Technology & Computational Design | AAD Spring

06  Seminar of Section
    Visual Studies | AAD Spring

07  Techniques of the Ultrareal
    Visual Studies | AAD Fall
04

Tensile/Compression Surfaces

Frei Otto Bubble Experiments with Strings

Sugar Surface Experiments: Material Test

Sugar Tensile Surface 1
Sugar Compression Surface 1

Sugar Tensile Surface 2
Sugar Compression Surface 2

Frei Otto Bubble Experiments with Wires
Rethinking BIM

Hudson Yards Transit Hub

This project is about designing a pedestrian-friendly mixed-used transit hub in Hudson Yards by providing good daylight conditions using BIM. To achieve this, we made three openings on the ground floor to allow the sunlight to reach the underground base with train platforms and transit circulation. We tested solar fans in different rush hours in Grasshopper with a ladybug plugin and carved out the building mass, designed based on the Hudson Yards district zoning regulations. Facades are designed to maximize the sunlight reflection to redirect it to the underground platform. We angled the reflective curtain wall by calculating the average angle between the sunlight and reflected light vectors.
Techniques of the Ultrareal
Measurement

08 Immeasurable Sites
Urban Design Seminar | AAD Spring

09 History of Architecture Theory
History & Theory | AAD Fall

10 Transclarities
AAD Required | AAD Summer
Year: 2023
Instructor: Emanuel Admassu

Immeasurable Sites

Measuring and Traveling

Un[Ctrl]able: Bruther X Pierre Huyghe

[New Generation of Research Center] X [After ALife Ahead]

[Residence of Researchers] X [A Forest of Lines]
The History of Architecture Theory

Year: 2022
Instructor: Mark Wigley

The History of Architecture Theory

Chapter 1: The Development of Architecture

In the early stages of human history, architecture developed as a means of shelter and protection. The earliest structures were simple,临时性建造，如穴居人的洞穴和原始人的小屋。随着技术的进步，人们开始建造更为复杂的建筑，如埃及的金字塔和古希腊的神庙。这些建筑不仅提供了居住和宗教的功能，还体现了设计和工程的智慧。

Chapter 2: The Influence of Classical Architecture

Classical architecture, with its emphasis on symmetry, proportion, and harmony, had a profound influence on the development of Western architecture. The works of ancient Greeks and Romans, such as the Parthenon and the Pantheon, served as models for architects throughout the centuries. The Renaissance period, with its revival of classical ideals, further popularized the use of classical elements in architecture.

Chapter 3: The Industrial Revolution and Modern Architecture

The Industrial Revolution brought about significant changes in the way buildings were designed and constructed. The use of new materials like steel and concrete allowed for the creation of large, functional structures. Modernist architects, such as Le Corbusier and Frank Lloyd Wright, emphasized simplicity, functionality, and the integration of technology into design.

Chapter 4: Postmodern Architecture

Postmodern architecture emerged as a reaction to the excesses of modernism. It embraced historical allusions and a playful approach to design. Postmodernists sought to create a sense of wonder and surprise in their buildings, often incorporating elements from different periods and styles.

Chapter 5: Contemporary Architecture

Contemporary architecture is characterized by a focus on sustainability, technology, and the integration of nature. Architects today are exploring new materials and technologies, such as bio-degradable plastics and 3D printing, to create buildings that are not only beautiful but also environmentally responsible.

Conclusion

Architecture is a timeless art form that continues to evolve with the changing needs of society. From the simple dwellings of prehistoric times to the complex skyscrapers of the modern era, architecture reflects the values, beliefs, and aspirations of its creators and inhabitants. Through the ages, architects have responded to the challenges of their time, creating buildings that are both functional and aesthetically pleasing.
Transclarities: Arenas of Design

Vulnerable Isolated Wonderland
- Focusing on EPOS -

We Disney created the reflected placid community also known as the Experimental Frontier Community in San Diego in the late 1980s. As a result of this project, he aimed to add some complexity are instead of existing another Disneyland a neighborhood where residents would live as well as play. The master plan of EPOS was to ensure a black hole city that was about 150 miles away and could not be seen or heard by anyone else. It was an undeveloped area far from the bustling city, though EPOS would eventually be known as the future city of tomorrow's fantasy. It was a unique opportunity to create a new urban landscape, and the designers struggled with the idea of how to develop it. The community was to be a place of refuge from the hustle and bustle of the real world, a place where people could escape and be themselves.

The transportation system on EPOS was so innovative, the city of tomorrow seemed to be a reality. The infrastructure was not only integral but also essential. The city was designed to be a self-sustaining community, with all necessary facilities and services within walking distance. The system was so efficient that it could even transport goods and people from one location to another, creating a seamless integration of urban and rural life.

The city of tomorrow was envisioned as a place where people could live in harmony with nature, where technology and nature coexisted. The designers aimed to create a community that was not only sustainable but also enjoyable. The city was designed to be a place where people could be creative and express themselves, where traditional and modern elements coexisted.

The community was also designed to be a place of adventure and discovery. The designers aimed to create a place where people could explore and be inspired, where the boundaries of reality and fantasy blurred.

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